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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/676,066	09/30/2003	Philip J. Ireland	2000-0995.01US	7725
7590	09/08/2004			
Kevin D. Martin MS 1-525 8000 S. Federal Way Boise, ID 83706-9632			EXAMINER PHAM, THANHHA S	
			ART UNIT 2813	PAPER NUMBER

DATE MAILED: 09/08/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/676,066	Applicant(s) IRELAND, PHILIP J.	
	Examiner Thanhha Pham	Art Unit 2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>09/30/03</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claim 4-5 and 8-10 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

- With respect to claim 4, “said second tunnel in said dielectric layer having a generally square or rectangular shape” renders the claim indefinite. It is not clear “said second tunnel” or “said dielectric layer” would have a generally square or rectangular shape.
- In claim 5, line 1, it is not clear where “said void” comes from.
- With respect to claim 8, “said void in said dielectric layer having a generally square or rectangular shape” renders the claim indefinite. It is not clear “said void” or “said dielectric layer” would have a generally square or rectangular shape.
- With respect to claim 9, “said void in said dielectric layer having a generally trapezoidal shape” renders the claim indefinite. It is not clear “said void” or “said dielectric layer” would have a generally trapezoidal shape.
- With respect to claim 10, “said void in said dielectric layer being interposed between said first and second conductive lines” renders the claim indefinite. It is not

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clear that "said void" or "said dielectric layer" is interposed between the first and second conductive line.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1-2 and 4-10 are rejected under 35 U.S.C. 102(b) as being anticipated by Fang et al [US 5,994,776].

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➤ With respect to claim 1, Fang et al (figs 6-9 & 19, col 1-7 more particularly col 5 lines 14-67, col 6 lines 1-5 and col 7 lines 24-62) discloses a semiconductor device comprising:

first and second spaced conductive lines (12, figs 6, 9 & 19, col 5 lines 31-35);

a dielectric layer (21, figs 6 & 19) in a region(14a) which extends from said first conductive layer (12) to said second conductive line (12) and is interposed between said first conductive line (12) and said second conductive line (12); and

first, second and third spaced tunnels (spaces 22's, figs 6, 9 & 19) within said dielectric layer (21) in said region (14a) which extends from said first conductive layer (12) to said second conductive line (12) and is interposed between said first conductive line (12) and said second conductive line (12).

➤ With respect to claim 2, Fang et al (figs 6, 9 & 19) show that:

said second tunnel (a space 22a in region 14a, fig 6 or 9) interposed between said first and third tunnels; and

a cross-section area of said second tunnel (22a, fig 19) and a cross-section area of each said conductive line (12), wherein said cross-section area of each said conductive line (12) and said second tunnel are about equal.

➤ With respect to claim 4, Fang et al (fig 6 & 19, col 5 lines 59-64) discloses the second tunnel (22a) having a generally square or rectangular shape.

➤ With respect to claim 5, Fang et al (figs 9 & 19, col 5 lines 64-67 and col 6 lines 1-5) shows the second tunnel (22c) having a generally trapezoidal shape.

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➤ With respect to claim 6, Fang et al (figs 6-9 & 19, col 1-7 more particularly col 5 lines 14-67, col 6 lines 1-5 and col 7 lines 24-62) discloses a semiconductor device comprising:

a semiconductor substrate assembly comprising a semiconductor wafer section (31,fig 19);

first and second conductive lines (12,figs 6, 9 & 19) having, in cross section, a width and a height;

a dielectric layer (21, figs 6, 9 & 19) between said first and second conductive lines, said dielectric layer (21) having a void (e.g. 22a) therein, said void comprising a width and a height about the same as said width and said height of said first and second conductive lines (see fig 19 for details).

➤ With respect to claim 7, Fang et al (figs 9 and 19) shows the void (22e) having a length substantially longer than either of said width and said height of said void.

➤ With respect to claim 8, Fang et al (figs 6 and 19) shows said void (22a) having a generally square or rectangle shape.

➤ With respect to claim 9, Fang et al (fig 9 & 19) shows said void (22c) having a generally trapezoidal shape.

➤ With respect to claim 10, Fang et al (fig 6, 9 and 19) discloses said void being interposed between said first and second conductive lines.

3. Claims 1-2, 4, 6, 8 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Pang [US 6,177,329].

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➤ With respect to claim 1, Pang (figs 13 & 14, col 1-13) discloses a semiconductor device comprising:

first and second spaced conductive lines (122, figs 13 & 14, see figure below);

a dielectric layer (112, figs 13 & 14) in a region which extends from said first conductive layer (122) to said second conductive line (122) and is interposed between said first conductive line (12) and said second conductive line (12); and

first, second and third spaced tunnels (136, figs 13-14, see figure below) within said dielectric layer (112) in said region which extends from said first conductive layer to said second conductive line and is interposed between said first conductive line (122) and said second conductive line (122).

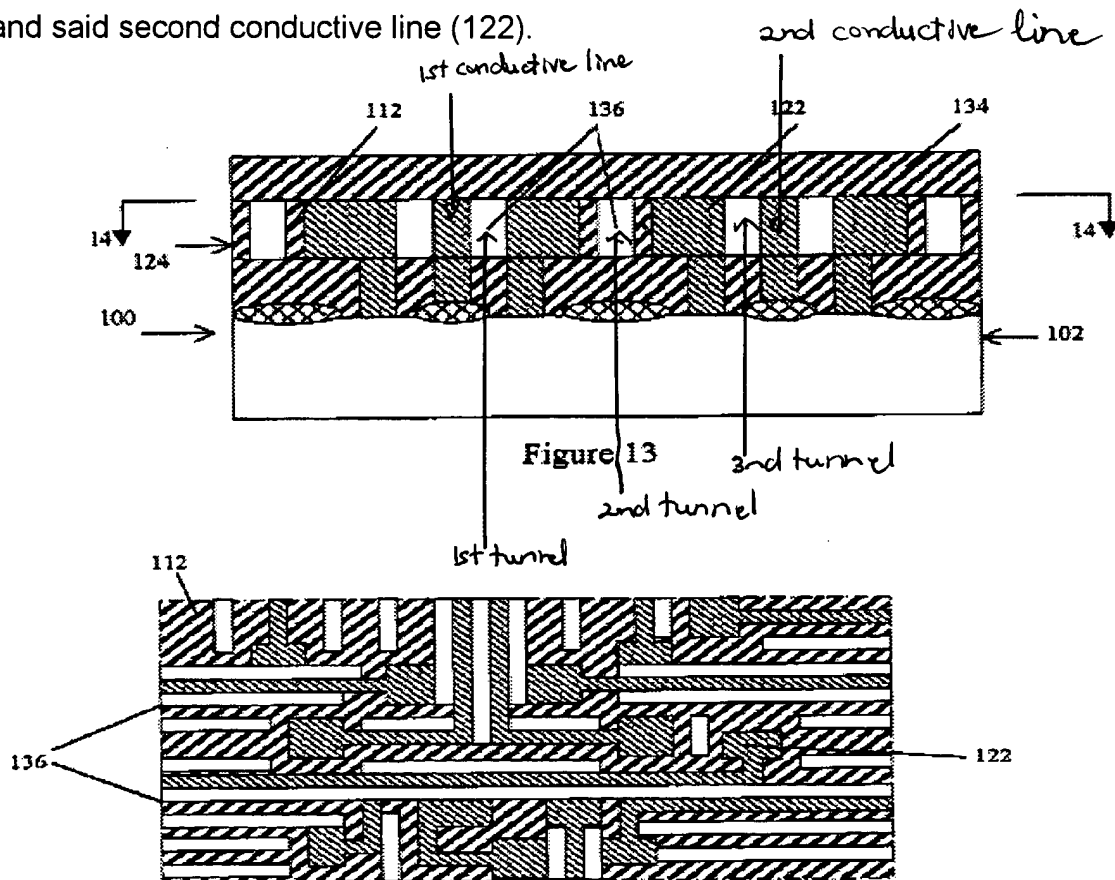
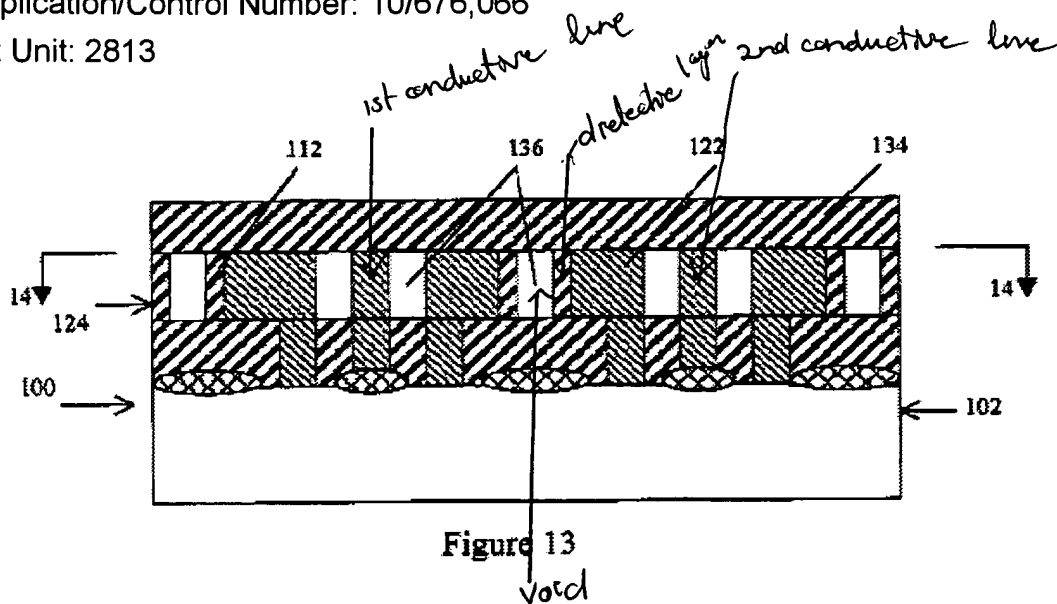


Figure 14

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- With respect to claim 2, Pang (fig 13) shows that:
 - said second tunnel (136) interposed between said first and third tunnels; and
 - a cross-section area of said second tunnel and a cross-section area of each said conductive line (122), wherein said cross-section area of each said conductive line (122) and said second tunnel are about equal.
- With respect to claim 4, Pang et al (fig 13) discloses the second tunnel (136)
- With respect to claim 6, Pang (figs 13 & 14, col 1-13) discloses a semiconductor device comprising:
 - a semiconductor substrate assembly (102, fig 13) comprising a semiconductor wafer section;
 - first and second conductive lines (see figure below) having, in cross section, a width and a height;
 - a dielectric layer (112, fig 13) between said first and second conductive lines, said dielectric layer having a void (see figure below) therein, said void comprising a width and a height about the same as said width and said height of said first and second conductive lines.
- With respect to claim 8, Pang (fig 13) shows said void (see figure below) having a generally square or rectangle shape.
- With respect to claim 10, Pang (fig 13) discloses said void (see figure below) being interposed between said first and second conductive lines.



Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. **Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fang et al [US 5,994,776] or Pang [US 6,177,329] as applied to claim 1 above in view of Mao et al [US 6,406,992].**

With respect to claim 3, the claimed range cross-section area of each of the first and third tunnels relative the cross-sectional area of each of said conductive lines and said second tunnel would have been obvious to an ordinary artisan practicing the invention because, absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover optimal or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

Furthermore, it appears that these changes produce no functional differences and

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therefore would have been obvious. See *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). See Mao et al as an evidence that shows using the tunnel (110, fig 1F) with the cross-sectional area smaller than the cross-sectional area of the conductive line (114).

5. Claims 5, 7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pang [US 6,177,329] as applied to claims 1 and 6 above in view of Fang et al [US 5,994,776].

➤ With respect to claims 5 and 9, Pang substantially discloses the claimed semiconductor except teaching that second tunnel/the void is a generally trapezoidal shape/ However, the claimed shape of the second tunnel or the void would have been obvious to those skilled in the art because of absent evidence of disclosure of criticality of the trapezoidal shape of the second tunnel or said void. *In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966) (The court held that the configuration of the claimed container was a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the claimed container was significant.). Moreover, Fang et al (fig 9, col 59-67 and col 6 lines 1-5) teaches using the tunnel/void with trapezoid shape in the dielectric layer (21) to reduce capacitance in interconnection. Therefore, at the time of invention, it would have been obvious for those skilled in the art to modify the semiconductor device of Pang by using the tunnel with trapezoidal shape of Fang et al to reduce capacitance of interconnection in the semiconductor device for decreasing signal delay of semiconductor 's operation.

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➤ With respect to claim 7, the claimed range of length of the void relative to said width or height of said void would have been obvious to an ordinary artisan practicing the invention because, absent evidence of disclosure of criticality for the range giving unexpected results, it is not inventive to discover optimal or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

Furthermore, it appears that these changes produce no functional differences and therefore would have been obvious. See *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990). See Fang et al (figs 9 and 19) as an evidence that shows the void (22e) being a tunnel having a length substantially longer than either of said width and said height of said void.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thanhha Pham whose telephone number is (571) 272-1696. The examiner can normally be reached on Monday and Thursday 9:00AM - 9:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Thanhha Pham


CARL WHITEHEAD, JR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800